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Corresponding Species Found in the Drainage of the Upper Ohio.
Ann. Carnegie Museum, Vol. XIII p. 145-182.

(4) Ortmann, A. E.
'11. A Monograph of the Najades of Pennsylvania.
Mem. Carnegie Museum, Vol. IV pp. 279-347.

(5) Peck, R. Holman.
'77. The Structure of the Lamellibranch Gill.
Q.Jour. Mis. Sc. N. S. XVII pp. 43-66.

Notes on Alabama Plants.

BY W. WOLF, O. S. B.

A New Monotropoid Plant.

I.

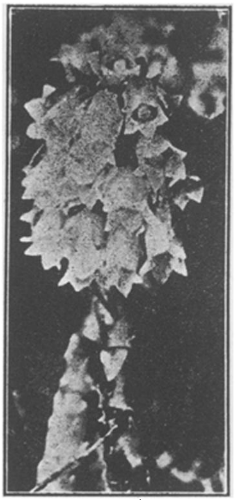
About the first of November, 1901, my attention was drawn to the discovery of a plant by Brother Norbert Knapke, who detected it while he was raking leaves in the forest of the St. Bernard College estate, Cullman County. The man was very enthusiastic about the plant, never before observed by him. He described the plant as leafless, with bell-shaped flowers almost ready to expand. At that time my interest in plant life was very limited. At the man's urgent request, however, I finally consented to accompany him to the habitat of the plant. Having reached the place, he removed the covering viz., fallen leaves of successive seasons, and exhibited a fine group of about a dozen scapes. These scapes were in excellent state and the flower buds far advanced. To all appearence it seemed but a question of a few days or possibly a week until the plant would be in full bloom. Having seen the plant, I was now easily induced to repeat the visit after a few days. In those days, the stock law was not in force, in this section of the state, and this accounts for the loss of the plant. On our next visit we found the whole group of plants uprooted. Two scattered scapes were picked up and preserved, more as a matter of curiosity than for any special scientific purpose. The fatal incident, instead of lessening, rather stimulated my interest in the plant. A search to re-discover the plant was immediately undertaken and renewed a few times later, without success. I also desired to learn the name either of this particular plant, or at least of one closely akin. Since the Botanical Department of the College did not exist in those days, I appealed to the librarian of the College, through whose courtesy I became supplied with the fifth edition of Gray's Manual of Botany. Owing to my ignorance of elementary botany, I was unable to master the arrangement of its contents. I succeeded however, in satisfying my desire; for, the text on *Schweinitza odorata* appeared to represent a plausibly fitting description for the plant of Brother Knapke's discovery. Thus the first phase concerning the newly discovered plant came to an end.

On October 25th, 1905, a tuft of several scapes was discovered by Mr. Gamer and delivered to me. A few weeks later (November 23rd) an undergraduate of the College, now Rev. Bede Knapke, discovered a few other groups. The discovery was promptly reported to me, and stimulated a new impetus in the study. In both cases the plant, including flower buds, were found grown to almost the same degree of development as those discovered in 1901. This fact supported the assumption that the plant might truly represent a fall-flowering species. My interest was aroused in this new direction and, in order to obtain conclusive data on the point in question, I determined to make the plant the object of continuous observation. One group was taken home and transplanted in a secure place in the open ground. The others were left in their native habitat with the intention to visit the place frequently. No result was obtained, however, for the plants in the native haunt, as well as the transplanted one sooner or later died. Most probably, with present-day knowledge concerning the plant's behavior towards the factors of its surroundings, the failure could have been avoided. On December 28th, 1909, an insignificant tuft (three scapes) was found by the original discoverer, N. Knapke. When the report reached me, I set out for the place and made a cut in the ground in order to divide the tuft. One scape was left in the place for control; the others were taken home and potted. The room wherein the potted plant had been placed was kept at a moderate temperature during the day. At night, when weather conditions became severe, the temperature occasionally dropped below the freezing point. The flower buds were already somewhat less than full-size when the plant was discovered. During the following weeks neither the potted scapes nor the one left in the native habitat showed any perceptible progress; neither did they show any sign of deterioration. Five or six weeks after the time of discovery, the scape in the field was found broken and thus lost as control object. The potted plant remained in a state of apparent dormancy during January and February 1910, but became perceptibly active with the approach of March. About the tenth of that month the corolla of the first flower expanded, the others following in turn. Almost simultaneously (in the middle of March) the discovery of a colony of plants offered the opportunity to test the above result under normal outdoor conditions. Comparison proved that the tenth of March is to be considered a somewhat too early date for anthesis. The new discovery marks a further significant date in the history of this Alabama plant in that this colony served for some years as field object for the study of the plant's behavior during the whole course of its season, from the appearance of the scapes to the ripening of the fruit. Afterwards, the plant was discovered more frequently, so that all in all, a few thousand scapes have come to my notice. Thus the plant and its behavior is well understood at present.

I take pleasure in acknowledging my gratitude to Brother Norbert Knapke, the discoverer of the plant. Most of the discoveries must be accredited to him, for without his enthusiasm, his urgent persuasion and his never-failing reports of new findings, I should not have been able to offer this modest contribution to science. For the photographs accompanying this paper, I am indebted to Rev. Bede Knapke, O. S. B., to whom I likewise wish to express my gratitude.

CRYPTOPHILA PUDICA.

PLATE I.



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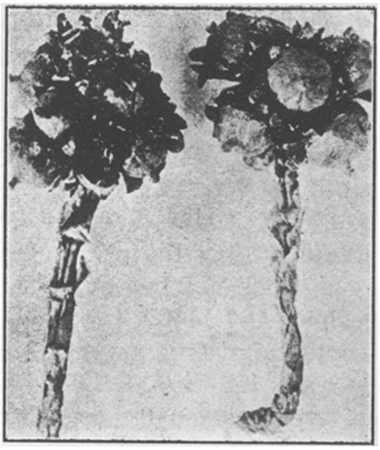

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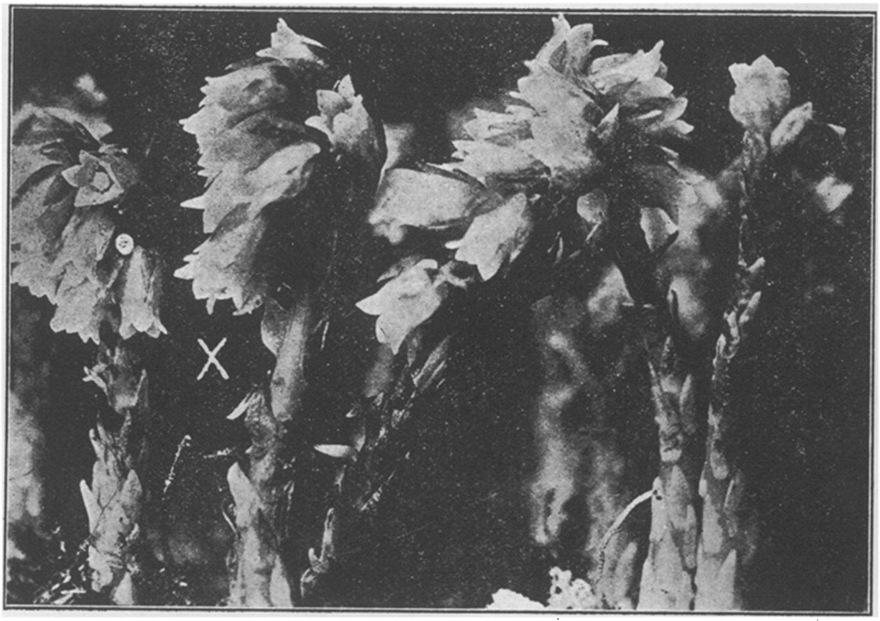

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II.

ROOTS: The root-system resembles a slender, mostly repeated many-branched, creeping rhizome. It is light brown or yellowish and more or less densely covered by micorhiza, the main strands being about 1 mm. thick.

SCAPE: The scapes, underground part included, are from 4.5 to 10 cm. high and mainly 4-8 mm. thick. The average scapes vary from 5-8 cm. in height and even vigorous ones almost invariably do not exceed 9.5 cm. The scape is of a succulent-waxy texture and like all parts of the plant, glabrous. The number of scales varies exceedingly in different specimens—from a few to more than fifty—and are either remote, approximate, or more or less densely imbricated. They are 4-10 mm. long, ovate, ovate-oblong or linear-oblong, but are occasionally of a broad type, especially the lower ones, which are deltoid-ovate to orbicular-ovate. The apex is obtuse or acute, the sessile base truncate and the margin entire or slightly erose near the apex. Their texture is suc culent but sooner or later, they generally become membranous.

INFLORESCENCE: The inflorecence is racemose but in apearance ranges from head-like to spike-like; it is one-sided, conspicuously bracted and bracteolate, 1-16 (more often 4-13) flowered. The rachis, from lowest to uppermost bract is 0.5-1.5 cm. long—somewhat longer in extraordinary cases—but never exceeding 2.3 cm. The length of the rachis is independent of the number of flowers and may be less than 1 cm. in a 12-flowered inflorescence. The bracts are 8-11 mm. long, 5-8 mm. wide, ovate-accuminate to orbicular-accuminate, entire, erose, erose-denticulate or erose-laciniate above the middle. The two bractlets at the base of the pedicel are somewhat shorter than the bracts, mainly oblanceolate, and more frequently erose. Occasionally from one to three additional bractlets may be present and these are then distributed along the pedicel. In texture the bracts and bractlets are succulent but in most cases become membranous. The pedicels are 2-10 (mostly 4-8) mm. long.

FLOWER: The flowers are regular, pentacyclic and normally pentamerous. It sometimes occurs that one or more flowers in an inflorescence deviate from this plan. In certain cases each and every cycle of the flower becomes affected and the arrangement of such flowers is still according to a uniform plan. In other cases only the androecium, or the corolla, or both androecium and corolla are affected. With a single exception deviation has been found to occur in the direction of an increase of members in the affected cycles. Those flowers which are still arranged according to a uniform plan are either hexamerous or heptamerous. One case is known in which a single octomerous flower occurred, and likewise a single instance is known where deviation from the normal occurred in the direction of reduction. In the latter case the flower was tetramerous. It has been found that if deviation in all cycles occurs only in a single flower, it is always the terminal one, and if in more than one, the terminal one represents one of them. (Lately two scapes with tetramerous flowers have been found; in one instance two flowers, the terminal one among them; in the other one which was not the terminal. Thus the above statement does not hold true in all cases, at least not with reference to reduction-deviation.)

CALYX: The sepals are distinct and vary considerably in length. They are either as long, shorter, or longer than the corolla, measuring 7-13 mm. They are oblong or somewhat oblong-lanceolate, truncate and one-grooved at the base, obtuse, acute or acuminate, entire or slightly erose at the apex. The inner ones are more or less fornicate. Like the scales and bracts, they are of a succulent texture, which character is frequently found unchanged in anthesis. Sepals and corolla-lobes are imbricated in the bud.

COROLLA: The sympetalous persistent corolla is campanulate, cylindric-campanulate, or sometimes cylindrical, 5-(respectively 4-8) lobed, 5-(4-8) saccate at the base, and 7-11 mm. long. The lobes are ovate or round-ovate, obtuse or acute, one-third to one-fourth the length of the corolla, and spreading in anthesis. In texture the corolla is succulent or rather waxy, especially the lobes.

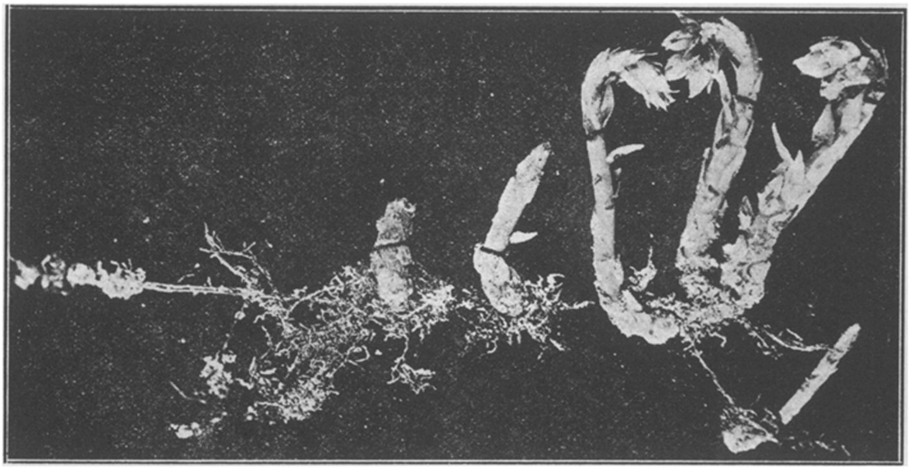
DISK: The hypogynous disk is distinctly 5-lobed; each lobe is reflexed and manifestly emarginate.

ANDROECIUM: The androecium consists of twice as many stamens as there are members in the calyx, corolla and pistil. The stamens opposite the sepals are inserted below the disk, those opposite the sepals apparently between the lobes of the disk. The anthers are adnate, the connective is manifest and rather stout in comparison to the size of the anther which is transversely 2-saccate with one sac superposed above the other, the sacs facing introrsely. The connective is generally reddish or brownish-purple, the sacs white or cream-color, becoming yellow at maturity. A shallow groove along the connective indicates the position of the vertical partition which is as long as the anther. It is not marked off along the introrse face of the anther, because it is only imperfectly developed; its best development being in the region where it is crossed by the transverse partition. The transverse partition is small but for the first more complete than the vertical one and is responsible for the transverse constriction of the anther. As development of sporogenous tissue progresses, the sacs bulge out considerably and become confluent. The line of constriction does not become markedly obscured and the individual sacs are still recognizable at maturity. Before the anthers mature, two oval spaces become faintly marked off, one on each side of the connective, which develop into large pores through which the pollen is discharged. The partitions remain attached to the connective which, at maturity of the anther, loses its prominent character on account of exsiccation and of warping. With the approach of maturity the anther makes a turn of less than 90 degrees; thus the pores assume a terminal position. The filaments are at first somewhat stout but become filiform and are generally reddish or purplish.

GYNOECIUM: The compound 5-(respectively 4-8-) carpellate pistil is snow-white and of a firm waxy texture. The ovary is subglobose to globose-ovoid, slightly 5-(4-8-) lobed by primary grooves and, in its lower part, 10-(8-16-) lobed through additional secondary grooves. The style is short, about 1.5 mm. long and thick, not hollow but inconspicuously

CRYPTOPHILA PUDICA.

PLATE II.



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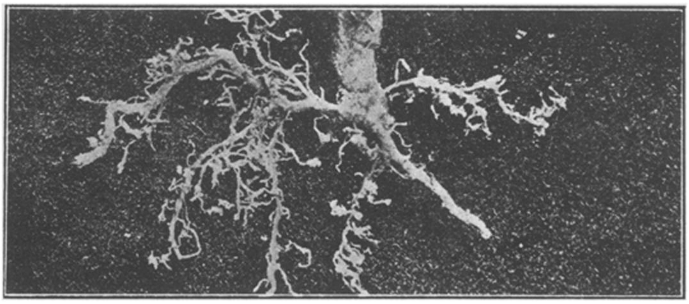

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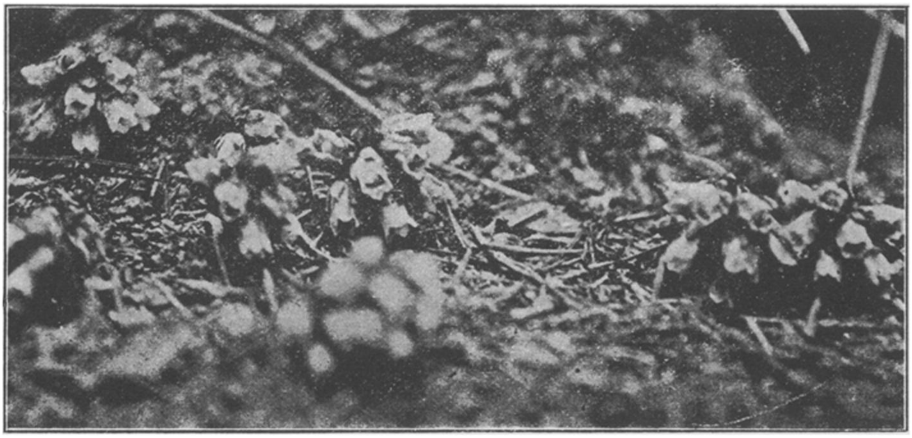

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5-(4-8) cleft. The stigma is subglobose or hemispheric (not angled), and appears as if 5-(4-8-) valved or crenate owing to longitudinal ridges extending, and gradually decreasing towards the base of the spical funnel-form apperture which at maturity is filled with secretion. The cavity of the ovary is distinctly one celled with 5 pouches near the the base, the large parietal placentae are cordate-deltoid in cross-section, and covered all over with numerous anatropous ovules.

FRUIT: The indehiscent fruit is baccate, subglobose, tipped with the persistent style and stigma, and 0.7 to hardly 1 cm. in diameter. In shrivelling it becomes more or less ovoid-rostrate and corrugated. The red or orange seeds are about 0.5 mm. long oval to ovoid and flexuously sulcate or somewhat reticulated. The testa is firm and in conformity with the nucleus.

III.

There exists a certain degree of relationship between the Alabama plant and the genus *Monotropsis* Schweinitz (*Schweinitzia Ell*). Thus a brief comparative study concerning these types may not be out of place. For this purpose the following literature has been consulted:

1. Elliott, Steph., A Sketch of Botany of South Carolina and Georgia. 1: 479. 1821.*
2. Nuttall, Thom., The Genera of North America. 2: Add. 3. 1817.
3. Rafinesque-Schmalz, C. S., American Monthly Magazine. 3: 99. 1818.
4. Don, G., A General History of the Dichlamydeous Plants. 3: 867. 1834.
5. de Candolle, A. P., Prodromus Systematis Naturalis Reg. Veg. 7: 780. 1839.
6. Gray, Asa. Manual of Botany. Rev. Ed., 246. 1858.
7. Proceedings of the American Academy of Science and Arts. 7: 368-70. 1868. and 20: 300-01. 1885.
8. "Synoptical Flora of North America." 2: 18, 49, 386. 1886.
9. Chapman, A. W., Flora of the Southern United States, 267. 1860.
10. Britton, N. L. & Brown, A., Illustrated Flora of the Northern United States etc. 2: 555. 1897.

11. Britton, N. L., Manual of the Flora of the Northern U. S. & C. 2d. ed. 696. 1905.

12. Small, J. K., Flora of the Southern United States. 880. 1903; also 2d. ed.

13. Robinson, B. L., & Fernald, M. L., Gray's New Manual of Botany. 630. 1908.

14. Engler, A. & Prantl, K., Die Natuerlichten Pflanzenfamilien. 4. F., 1. Abt. 9-11. 1897.

* For actual date of publication consult J. H. Barnhart, Bull. Forr. Bot. Cl. 26: 376. 1899. & 28: 680-88. 1901.

Monotropsis has a calyx of 5 distinct sepals and a sympetalous corolla. It has also a manifest disk, which is described by earlier authors as 5-cleft (1), (2), (3), (4), (5) and by later authors as 10-crenate (8), (10), (11), (15), repectively 10-toothed (13). A detailed statement on the position of stamens by Rafinesque (3) reads: "Stamens 10, a pair between each angle of the nectary." The anthers are in general described as clavate-saccate (1), (5), 2-saccate (6), (13), awnless (6), (8), (9), (11), (12), (13), (15), 1-celled (2), (4), 2-celled (6), (13), confluent (10), (11), (12), opening by pores (2), (4), (5), (8), (10), (11), (12), horizontal in the bud (8), (10), (11). Besides there are two statements by Gray (7) which are worth citing because the only ones referring to a transversely 2-saccate character of the anther; they read: "The anthers. . . . in the flower bud are horizontal, so that one cell stands directly above the other" * and "antherae. . . in alabastro transversae."

On comparing the description of the Alabama plant with the above compilation the following result is obtained. In both the Alabama plant and *Monotropsis,* the calyx consists of a complete series of distinct sepals and a sympetalous corolla. Both have a manifest hypogynous disk which is 5-lobed, with the lobes manifestly emarginate in the Alabama plant, and most probably so in *Monotropsis.* I base this assumption on the fact that the earlier authors describe the disk of *Monotropsis* as 5-cleft, while later authors describe it as 10-crenate and consider the difference rather a matter of degree in that the earlier authors ignore the secondary lobation as a mere trifle, referring only to the primary lobation while later authors seem to overrate the deepness of the secondary lobation. It may be stated here that the descriptions of certain, if not most of the authors, are not original, or else are based on herbarium material of this rare plant. The arrangement of the stamens in the Alabama plant is 2-cyclic in conformity with the pentacyclic flower-plan, which is the normal for the group of monotropoid plants. Rafinesque's statement cited above, indicates that in case of *Monotropsis*, deviation from the normal plan occurs. In accordance with the statement we are to assume suppression of one staminal cycle, the antipetalous one, accompanied by duplication of the members of the other (antisepalous) cycle. Now, as mentioned before, the later authors describe the disk of *Monotropsis* as 10-crenate, which means that there are ten spaces left which are not occupied by the disk. These unoccupied spaces correspond in number with the stamens, of which there are likewise ten. This suggests that each space represents the position of a respective single stamen. Judging from this point of view, it seems more likely that the arrangement of stamens is the same in *Monotropsis* as in the Alabama plant. I surmise that Rafinesque, relying on Schweinitz's conception of a 5-lobed disk, based his opinion upon the same evidence used in the above argument, viz., the number of available spaces—five in consequence of a 5-lobed disk. If so, then the presenting of mere inferences as positive facts would appear somewhat unscrupulous. In *Monotropsis* as well as in the Alabama plant the anthers are awnless, transversely 2-saccate, the sacs introrse, horizontal in the bud with one sac superposed above the other, vertical in anthesis, becoming confluent and opening by pores.

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* The figured anthers in Britton & Brown's "Illustrated Flora" are not transversely saccate. Anthers like this cannot be expected to have one sac stand directly above the other in the bud except one supposes a twist of the filament.

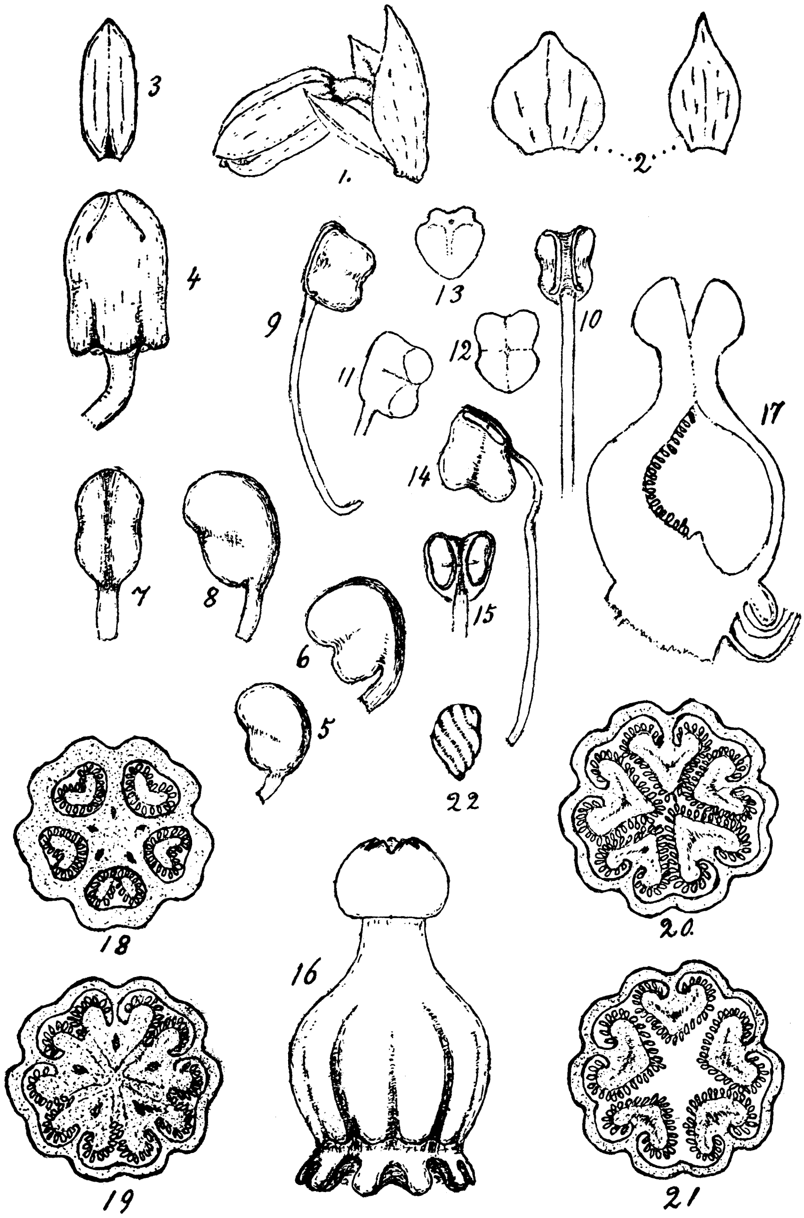
The conception of the genus *Monotropsis* is originally based on Schweinitz's description published in Elliott's Sketch (1). Unfortunately the text is seriously incomplete, containing no statement on the internal structure of the ovary and none whatsoever on fruit. It is therefore of no service for further comparative study. Nuttall (2) has a statement on fruit, but this becomes worthless because appended by a question-mark. It reads: "Capsule 5-celled?" It is copied by Don (4) and De Candole (5) has adopted it with reserve, placing the responsibility on Nuttall. Some of the later authors describe only the fruit as a 5-celled capsule (6), (9), (13); others mention also a 5-celled ovary (10), (11), (12). How far the statements of the respective authors are based on personal observations, I am unable to decide, for those on fruit as well as those on ovary are very uniform. It seems best, therefore, to rely on Gray's authority, as he was very much interested in the genus. Furthermore, as late as 1884 he established the species *Monotropsis Reynoldsiae* (7) of which he had at his disposal, besides other material, "A full series of freshly gathered specimens." In the Synoptical Flora (8) *Monotropsis* is classed with the tribe *Eumonotropeae* which is based on "Ovary 5-celled, or sometimes 4-celled; the placentae projecting from a thick central columella." The fruit character for the whole subfamily *Monotropeae* is specified as "Capsule loculicidal."

In the Alabama plant, on the contrary, the ovary is 1-celled, 5-pouched, only at the base, and the placentae are parietal; the fruit is indehiscent and baccate. Because of these essential differences the Alabama plant is to constitute a distinct genus, which becomes:

CRYPTOPHILA gen. nov.

Inflorescentia terminalis recemosa. Flores bractati et 2-bracteolati normaliter pentamerosi. Calyx 5-sepali persistens; sepala libera, aestivatio imbricata. Corolla sympetala persistens; limbus 5-fidus, aestivatio imbricata. Discus manifestus. Stamina decem; antherae adnatae, transversae 2-saccatae; sacci introrsi horizontales in alabastro verticales in anthesi, confluentes, 2-porosae dehiscentes. Pistillum unicum; germen in basi 5-loculare; placentae parietales. Fructus baccatus.

CRYPTOPHILA PUDICA.
PLATE III.



CRYPTOPHILA PUDICA spec. nov.
(Herb. St. Bernard College no. 1071.)

Planta perennis glabra. Radices usque ad 1 mm. crassae communiter coopertae densa micorhiza. Scapus erectus 4.5-10 cm. altus; squamulae sessiles, remotae, approximatae vel imbircatae, ovatae, ovato-oblongae, lineares-oblongae vel inferiores triangulariter ovatae, obtusae vel acutae. Inflorescentia quasi spica vel capitulum; flores 1-16; bracteae conspicuae orbiculato-acuminatae vel ovato-acuminatae; bracteolae oblanceolatae; pediculi 2-10 mm. longi. Sepala oblonga, obtusa vel acuta, interiora fornicata, 7-13 mm. longa. Corolla 7-11 mm. longa, campanulata, cylindrico-campanulata vel cylindrica, in basi gibbose 5-saccata; lobi ovati, obtusi vel acuti. Discus 5-fides; lobi reflexi et emarginati. Filamenta filiforma; connectiva conspicua, rubicundula vel purpurea; sacci albicantes post ea lutei. Germen parum 5-lobatum in inferiore parte 10-lobatum. Stylus brevis crassus. Stigma subglobosum vel hemisphaericum intus 5-fidum secundum apicalem infundibuliformem aperturam.—Flores raro tetramerosi, hexamerosi, heptamerosi vel octomerosi.—Bacca subglobosa 0.7 vix 1 cm. in diametrum. Semen circiter 0-5 mm. longum, test firma flexuose sulcatum vel parum reticulatum. Herba scaposa; scapus squamulosus. Planta non parasitica.—In silvis xerophilis Comitatus Cullman, Alabama.

There has also been discovered a single tuft of three scapes, which were from 15 to 20 cm. high. Scapes of intermediate size between this extreme form and the typical one have never been observed. It may thus be distinguished from the type as:

CRYPTOPHILA PUDICA forma MAXIMA f. nov.
(Herb. St. Bernard College no. 1452.)

On the other hand, the colony discovered in March 1910, already referred to in this paper, represented an extreme dwarf form. Under observation for some years, it showed no deviation during any of these seasons. It may, therefore, be designated as:

CRYPTOPHILA PUDICA var. KNAPKEI var. nov.
(Illustration 3 of Plate II.)

Radices usque ad 2 mm. crassae parum coopertae micorrhiza. Scapus subterraneus erectus 1.5-2 cm. altus exclusa inflorescentia. Inflorescentia supra terram paululum in terra infixa, capitulum; flores 3-9; rachis minus quam 1 cm. longa. Bacca circa 5 mm in diametrum.

The small group of plants known as *Monotropaceae, Monotropeae, Monotropoideae, Hypopityaceae and Hypopithieae* has been repeatedly changed with regard to rank and position in the systems of classification, due rather to minor points, for its relation to the large body of the Ericals is well established. Even at present no agreement has been reached and thus we find the group considered a distinct family, or a subfamily of the *Pyrolacia,* or again a subfamily of the *Ericacea* according to the opinions of different authors. As the group itself retains its integrity regardless of supposed rank or position, the matter is of no consequence in the present case. However, in order to determine the position of the new genus within the group of monotropoid genera we are concerned with the subdivision of the group into tribes of which two have been recognized hitherto, the *Eumonotropeae* and the *Pleuricosporeae. Cryptophila* differs from the *Pleuricosporeae* mainly in the ovary structure and the fruit character, and from the pleuricospóreae mainly in the anthers, in the presence of a manifest disk and in fruit. The arrangement thus becomes:

Tribe I. Eumonotropeae: Ovary several-celled; placentae projecting from a central columnella; fruit a loculicidal capsule; disk present or none. It insludes the genera *Allotropa, Pterospora, Sarcodes, Monotropsis,* and *Monotropa.*

Tribe II. Pleuricosporeae: Anthers opening by longitudinal slits; ovary one-celled or falsely several-celled through fusion of the 2-lamellate placentae; placentae parietal; fruit a loculical capsule; disk none. It contains the genera *Pleuricosporea, Newberrya* and *Cheilotheca.*

Tribe III. *Cryptophileae*s Anthers opening by pores;

ovary for the most part one-celled, several-celled near the base; placentae parietal; fruit indehiscent, baccate; disk manifest. Single known genus, *Cryptophila.*

IV.

With regard to the extent of the geographical range of *Cryptophila pudica* nothing is known at the present time. The only known station is St. Bernard, Cullman County, located east of longitude 87°, north of latitude 34°, and an approximate altitude of 800 feet above sea-level, in the southern part of the Carolinian area of the Upper Austral Life Zone. Topographically, the locality is part of the table-land of Northern Alabama. It is intersected by the channels of the Eight Mile Creek and its contributory brooks and brooklets, rather deeply cut and bordered by gradual or somewhat steep slopes or occasional bluffs. As the slopes approach more or less closely to the water channels the spaces of lowlands left are very insignificant as to extent. However, as to plant association these narrow stretches are to be considered distinct from the upland by its rather mesophile character. It is in the upland that the physiognomy of the regional plant formation, a xerophile mixed forest, finds its expression. Originally, the hardwood timber predominated; at present conifers (pines) gain preponderance, and in small areas the mixed forest has become replaced by pine growth. The mineral constituent of the soil of the place is derived mainly from the surface rock, which is sandstone. Along water-courses alluvial soil predominates, which is a soil too loose for the requirements of *Crystophila pudica,* and in accordance with this fact the lowlands have not proved a habitat of the plant. Likewise, the plant does not occur in pinelands, however, for a different reason viz., lack of protective cover. The true habitat of *Cryptophila p.* is the xerophile mixed forest of the upland. Here, with certain insignificant exceptions, the soil consists of a compact fine sandy loam When I first began to investigate the character of the root-system (inquiring at the same time about the plant's relation with regard to parasitism or saprophytism) I found the extracting of relatively uninjured root-systems a more tedious undertaking than I had expected, and this was due to the peculiarity of soil conditions in connection with the plant. To liberate root-systems of *Cryptophila p.* from the interwoven tangle of surface roots and rootlets of various herbaceous, exceptions, the soil consists of a compact fine sandy loam. should naturally represent its difficulties. Contrary to my expectation, however, I found the soil in close contact with the roots of *Cryptophila p.* and the interwoven tangle to be a clayey loam instead of sandy loam, fine-grained and sticky when moist, pulverulent when dry. Further investigations proved that this peculiarity* is a general feature and that the kind of soil is provided by extremely scant deposits not discernible in a general survey of the soil surface. Occasionally the roots are found growing in a mixture of clayey and sandy loam.

The season of the plant extends from the fall of the one to the summer of the next year, and is autumno-hyemal with reference to appearence of scapes and their full development, vernal with regard to anthesis, and aestival as to ripening of fruit. The earliest date recorded of scapes observed above ground is September 12th. This, however, like those cases where full-grown scapes were found in October or the early part of November are to be considered exceptions to the general rule. It is noteworthy, however, that the scapes of the colony of the variety *Knapkei,* discovered in March 1910 and under observation for some years, always appeared as early as the later part of September, while on the other hand, the first flowers always opened as late as the middle of April.

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* The discovery of this soil-pecularity at first led to wrong conclusions concerning the real habitat of the plant. Characteristic of the locality are, (or better were) small areas of the upland; shallow depressions with insufficient drainage and inundated during parts of the year. Here the soil is a similar clayey loam. As the areas are small there is no marked interruption in the general physiognomy of the xerophile upland forest. But the difference shown by the undergrowth is remarkable because, decidedly mesophile, or rather semipaludial. Since then experience proved that the xerophile forest is the true habitat of *Cryptophila,* and it has never been found in places like those just referred to, not even occasionally.

As a general rule scapes appear most frequently during the months of October-November, less frequently in December, and more rarely in September. The roots vegetate mainly about 1.5-2 cm. beneath the surface of the ground, and adventitious buds may be found at almost any time of the year. All parts of the plant are formed in the hypogaeus stage; scales and bracts reach more or less normal size but scapes and flower-buds become developed only to a certain extent; the flower-buds measure from 2-4 mm. at the time when the scapes emerge and are protected by the closely appressed bracts and bractlets. Scapes which appear above ground without having developed flower-buds in the hypogaeous stage do not, as far as observed, form such afterwards. The process of emergence requires a considerable space of time—from more than two to approximately five weeks. It is accomplished through the growth of the scape, much like many seedlings emerge i. e., the scape describing a semi-circle thereby lifting the inflorescence in a drooping manner, which position the inflorescence retains during the whole winter. The scapes grow slowly to about normal size while the flower buds become fairly developed—sepals more or less to full size, corolla to about two-thirds of the full length. The winter is then passed by the plant in apparent dormancy till March or the approach of April. The proper month for anthesis is April but early flowering plants may be found in bloom in late, or in rare cases, as early as the middle of March; while on the other hand, stragglers may flower as late as early May. The fruit ripens in July or early August.

Cryptophila pudica is never found freely exposed to the open. It grows, flowers and fruits under a cover of leaves which is twofold in character. The lower bulk, 2.5 to approximately 5 cm. thick is dense and consists of well settled fallen leaves accumulated during several successive years, and gradually decayed towards the lower strata, which are in contact and pass into the scant humus. These lower strata are generally much interwoven by hyphae and are thus felt-like. The top cover is rather loose and consists mainly of fallen leaves shed during the previous season. The cover is an essential feature to the welfare of the plant. Without it, *Cryptophila* *pudica,* depending on a season which extends over a period of from eight to eleven months, should have little chance to endure the severe changes of climatical conditions. The clayey instead of a sandy loam represents an additional protective factor against changes of meteorological conditions as it retains moisture more tenaciously. It is true, the amount of clayey deposits is too small to be effective under exposure but becomes so under the dense cover of leaves. While this cover is an essential factor to the general welfare of the plant it represents, on the other hand, an object of disadvantage in point of pollination, responsible for the fact that fruits are rarely produced. The pollen is shed in the bud upon the inner face of the corolla-lobes. Insects are attracted by the strong, not fragrant but aromatic odor. It strikingly resembles the odor of the Carophyllii aromatici (commonly known as cloves) and the oleum caryophyllorum (clove-oil) with a slight deviation in as much as it is not quite as pungent as that of the former, nor quite as mild as that of the latter. The spread of the odor is hardly perceptible except when the dense lower cover of leaves has become fissured and it is in this latter case that the strong insects are found actively engaged in forcing access to the hidden plant.

As the extent of the plant's season indicates, the plant is to pass the long period of the year above ground when temperature is low. The location of the station close to the 34° of latitude indicates that winters should not be considered severe in comparison to winters of more northern regions. On the other hand, the locality is freely exposed, being sheltered in no way by a mountain barrier against the influx of air currents. It may be said, in general, however, that if cold weather is continuous and lasting, night temperatures are rather even and the absolute minimum remains normally above 20 degrees. Otherwise it occasionally falls lower, even to 10 or still more rarely to 8 degrees. It has been proven during many years that all such temperatures are not harmful to the plant under its protective cover. A few instances are known where the floor-cover of certain areas had been removed and where afterwards plants have been discovered which were exposed to severe temperatures, probably even

10 degrees. Some of the plants had succumbed, others were not perceptibly injured; still, even of these, some died in course of time, the rest flowered in due season. Only in very exceptional instances does it occur that the temperature falls for a day or two below zero in this locality. As long as *Cryptophila pudica* was under observation such occurred only in 1918 and 1919. During both winters only a few groups were under observation or were discovered shortly after the cold waves. These were not injured at all and some of them, in time of anthesis, ranked among the finest specimens ever seen. The table below shows the absolute minimums for the months September to April with refence to the locality, which is taken from the official records of the U. S. Weather Bureau Station, located up to 1916 in Cullman, but since transferred to St. Bernard. Snow is of such rare occurrence and of such short duration that it is of no consequence as a factor in connection with the plant.

TABLE OF ABSOLUTE MINIMUMS.

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEBR.	MARCH	APRIL
1922					16	16	23	33
1921	61	30	27	21	25	23	28	29
1920	39	24	20	16	12	12	10	25
1919	46	52	25	15	11	20	24	24
1918	34	41	26	16	17	17	26	30
1917	46	22	20	5	16	4	17	30
1916	40	27	12	15	6	15	20	38
1915	46		24	21	19	24	25	33
1914	51	26	11	6	19	17	16	30
1913	36	20	19	20	22	18	22	34
1912	50	32	19	21	6	6	22	34
1911	57	32	19	18	6	18	22	36
1910	47	24	25	16	12	12	22	30
1909	39	27	23	8	9	13	26	30
1908	36	29	18	22	12	20	29	28
1907	46	32	21	19				

The color range of *Cryptophila pudica* is rather wide. Reddish tints in all degrees of shade, from reddish-pink to brownish-red predominate, while bluish tints from light lavender to darker hues, delicate pink, white with only the bundles red or pink, which shine through the semi-transparent tissue of scape, and pure white specimens are more rarely found. Frequently, scapes of lighter shades turn in course of time, into darker shades of red, while scales and bracts often, sooner or later, lose their succulent-waxy texture, becoming membranous, and fade to a grayish or yellowish brown. In such a state, especially in cases where numerous scales and the bracts are densely imbricated, the plant assumes an exsiccated appearance. This is to a great extent an individual character but it is frequently caused or furthered by meteorological factors, especially drought. The sepals retain the succulent character and original color longer, often till, or during time of anthesis, while the corolla, growing to fulness only shortly before the flowers expand, exhibits always a fine appearance as to color and texture in anthesis. Its tube is mostly of a slightly darker shade than the color of the plant in general and the lobes are white-margined. Individuals which in state of anthesis exhibit all their parts in the original freshness of color and texture represent beautiful specimens, especially those of lighter shades and the pure white ones. The surface of all parts has a slightly polished waxy lustre which adds to the fine appearance of the plant. The odor of the fresh flowers is that of cloves. In a specimen of peculiar beauty all the parts were of a light lavender, but the centers of the petals were dark blue or almost bluish-black, and contrasted strongly against the snow-white margin of the lobes. The plant finally becomes black with the exception of scales, bracts and sepals, in case these have changed color and texture beforehand, and the plant now assumes a disagreeable sour odor.

Cryptophila pudica may be considered a moderately rare plant with regard to its occurrence in this locality, although its hidden condition practically places it among the rarest plants. I must confess that neither I nor anyone else have ever come upon the plant under ordinary circumstances. It has been found only by way of raking the floor-cover of fallen leaves, which is a common practice among agriculturists of this region. As a result of such practice together with the felling of timber-trees, and partly of fires, the cover of leaves becomes too scant to provide effective shelter for the plant. Furthermore, claims on forest lands for agricultural purposes and for pasturage are factors in reducing the habitat of this plant. Fires, frequent in former times, proved most destructive not only as to the scapes of the respective seasons, but also to the root-systems. Therefore, in the last few years very little material has come to my notice, generally only scant remains from formerly known habitats.

With reference to the relation of *Cryptophila pudica* towards other plants, viz., parasitism, I must state that in no case have I found roots of this plant connected with roots of any other plant.

EXPIANATION OF PLATES ON CRYPTOPHILA PUDICA.

PLATE I.

1. Group of large scapes, showing both extremes, a one-flowered scape at the right, a sixteen-flowered scape (x) somewhat to the left—1 1-6 natural size.
2. Same sixteen-flowered scape, front view, at upper right corner—natural size.
3. Fruit at upper left corner—natural size.

CRYPTOPHILA PUDICA.

PLATE II.

1. Scapes with roots about natural size.
2. Roots 1 1-4 natural size.
3. Part of a colony of *Cryptophila pudica* var *Knapkei;* natural size.

PLATE III.

Figure 1.—Flower-bud showing position of bractlets. x3.
Figure 2.—Bracts. x2.
Figure 3.—Sepal. x2.
Figure 4.—Corolla in bud-condition. x3.
Figure 5, 6, 7, 8.—Young stamens. x20.
Figure 9, 10.—Immature stamens. x20.

Figure 11, 12.—Sections of anthers, lengthwise. x10.
Figure 13.—Section of anther, transverse. x10.
Figure 14.—Mature stamen. x10.
Figure 15.—Dorsal face of anther showing the large pores. x10.
Figure 16.—Pistil with hypogynous disk. x8.
Figure 17.—Section of pistil, lengthwise. x8.
Figure 18, 19, 20, 21.—Sections of ovary, transverse; (18) at the base, (19) near the base, (20) below the middle, (21) slightly above the middle. x8.
Figure 22.—Seed. x25.

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BOOK REVIEWS

In this section are reviews of new, or particularly important and interesting books in the fields of natural science. Books dealing with botany or kindred subjects should be sent to the Editor, the University of Notre Dame. *All other books for review* should be sent to Carroll Lane Fenton, at the Walker Museum, the University of Chicago, Ill. Publishers are requested to furnish prices with books.

WOODLAND TALES. By Ernest Thompson Seton. Doubleday, Page & Co. $2.00.

This new book of Mr. Seton's is addressed primarily to children of the ages of six to twelve years. But in the belief that the mother and father, or perhaps the campfire leader and scoutmaster, will act as leaders in the work, those chapters dealing with woodcraft are addressed to grown-ups.

The greater part of the book, however, consists of children's stories with a fable and fairy tale flavor. Their subjects, however, are plants and animals, and great care has been taken to make them both instructive and thoroughly accurate. The book is divided into sections, four dealing with the seasons, and seasonal aspects of biology, and two with nature games, woodcraft, etc. The whole reminds one of Mr. Seton's excellent nature manual, "Two Little Savages" in its wide scope and pleasing style, but is adapted to the use of smaller children than those who read the latter book. "Woodland Tales" may not make naturalists, but it will go far toward making nature students; in giving the child